

## Vehicle Technologies Program

# Shifting Gears to New Vehicles and Fuel Choices



Today, America imports more than half of the oil we consume, sixty-nine percent of which is used for transportation. Unless action is taken, the historical trend toward increasing dependence on foreign oil will continue. Research and development undertaken by the U.S. Department of Energy's (DOE's) Vehicle Technologies Program (VTP) is helping to change this trend.

VTP is actively developing and accelerating the deployment of advanced vehicle technologies that will enable American consumers to use less oil, without reducing vehicle and fuel choices. There are several activities VTP promotes to improve fuel efficiency and displace the use of petroleum.

- Development of hybrid-electric, plug-in hybrid-electric vehicles and fuel cell/hydrogen systems and sub-components that can provide significant improvements in fuel economy and petroleum displacement. This is a key part of the strategy of reaching the "Twenty In Ten" goal set by President Bush. By using electricity from the grid at off-peak hours, plug-in hybrids will achieve a significant reduction in petroleum use.

- Deployment of alternative fuels can rapidly reduce foreign oil consumption. VTP is a leader in facilitating the deployment of alternative fuels (ethanol blends, biodiesel, hydrogen, electricity) and fuel infrastructures through partnerships with state and local governments, universities, and industry.
- Reducing vehicle weight directly improves vehicle efficiency and fuel economy and can potentially reduce vehicle operating costs. The introduction of cost-effective, high-strength materials can significantly reduce vehicle weight without compromising safety.
- Improved combustion technologies and optimized fuel systems can provide near- and mid-term fuel efficiency gains. The goals are to improve efficiency for passenger vehicles to 45 percent by 2010 and for commercial vehicles to 55 percent by 2013.

These activities, among the other activities found in VTP's portfolio, will lead to a large reduction in the consumption of petroleum; significant reductions in carbon emissions, and a more secure nation. Reducing highway oil use has more

potential to improve the nation's energy security than any other action; even a one percent improvement in vehicle fuel efficiency would save consumers over \$2 billion annually.

In Fiscal Year 2009, to better manage synergies among hydrogen, biofuels, and hybrid technologies, as well as hydrogen and fuel cell systems, VTP will integrate the following program elements from the Hydrogen, Fuel Cell and Infrastructure Technologies Program: Technology Validation; Safety, Codes and Standards; and Education.

### Partnering for Success

VTP's success depends on its relationship with universities, vehicle and engine manufacturers, material suppliers, non-profit technology organizations, energy suppliers, and the national laboratories. The FreedomCAR and Fuel Partnership and the 21st Century Truck Partnership are designed to identify and select appropriate research and development objectives. Projects are conducted through a variety of mechanisms including cooperative agreements, cooperative research and development agreements (CRADAs), university grants, subcontracts, and in-house research funded at DOE's national laboratories.

### Vehicle Technologies Program Components Work Together, Achieve Results

**Hybrid Electric Systems** (Vehicle and Systems Simulation and Testing, Technology Validation, Energy Storage R&D, Advanced Power Electronics and Electric Motors R&D) – Hybrid-electric systems R&D activities continue to be a hugely successful part of DOE's vehicle research program. Activities include: evaluation and validation of technology integration; component and vehicle benchmarking; development and validation of heavy hybrid propulsion technologies and hydrogen/fuel cell systems; and developing technologies to reduce the parasitic losses from commercial vehicle systems, all of which are integral to VTP's continued success.





Energy storage technologies, especially batteries, are critical enabling technologies for the development of advanced, fuel-efficient for light- and heavy-duty vehicles. The development of durable and affordable advanced batteries are essential for wide-spread integration of hybrid-electric and plug-in hybrid-electric vehicles.

Power electronics and electrical machine goals will require the development of new technologies. These technologies must be compatible with high-volume manufacturing; must ensure high reliability, efficiency, and ruggedness; and must simultaneously reduce cost, weight, and volume.

Technology validation confirms that component technologies can be incorporated into a complete system solution, and that system performance and operation are met under all operating scenarios. It is important to compare VTP research results with similar work performed worldwide. Through laboratory testing, researchers compare vehicles and components to validate models, support the setting of technical benchmarking targets, and provide data to guide technology development.

**Advanced Combustion Engine R&D** (Combustion and Emission Control, Heavy Truck Engine, Solid State Energy Conversion, Health Impacts) – Researchers at the national laboratories and in private industry are working to identify technologies, configurations, and engine control strategies that achieve the best combination of high fuel economy and low emissions for advanced internal combustion engines, advanced diesel

engines, hybrid-electric and fuel-cell vehicles, and other alternative-fueled vehicles.

**Materials Technology** (Propulsion Materials Technology, Lightweight Materials Technology, High Temperature Materials Laboratory) – VTP focuses much of its effort on improving vehicle fuel economy while meeting increasingly stringent emissions standards. Achieving these goals requires a comprehensive understanding of relationships between fuel economy, emissions, and engine and hybrid system control strategies, in order to minimize the fuel economy penalty associated with emissions control.

The use of lightweight, high-performance materials will contribute to the development of vehicles that provide better fuel economy, yet are comparable in size, comfort, and safety to today's vehicles. The goal is to develop and validate cost-effective high strength materials technologies that could significantly reduce vehicle weight without compromising cost, performance, safety, or recyclability.

**Fuels Technology** (Advanced Petroleum Based Fuels, Non-Petroleum Based Fuels and Lubricants) – The fuels and lubricants effort supports R&D that will provide consumers with fuel options that are cost-competitive, enable higher fuel economy, deliver lower emissions, and reduce the use of imported oil. For example, the effort is evaluating the impacts of intermediate blends of ethanol (e.g., E15 and E20) in gasoline on performance, emissions and durability of the existing vehicle fleet and on small, non-road engines.

**Technology Integration** (Graduate Automotive Technology Education, Advanced Vehicle Competitions, Education, Safety and Codes and Standards, Legislative and Rulemaking) – Integrating newly validated technologies involves a multi-faceted challenge incorporating education, and training, development of new codes and standards, consumer education, and early adopter support, as well as supporting relevant legislative and rulemaking activities. Technology integration achieves this through integrated partnerships with state and local governments, universities, industry, and standards-setting organizations.



## A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.



U.S. Department of Energy

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